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on the basis of something more than a superficial knowledge of its content, can do so with all sincerity. It is legitimate that we should struggle to make it as popular a science as may be without discarding its essentially rigorous methods, for, as Dr. Nutting has said, the typical product of slack methods is a slacker.³⁴ But difficulties will only serve to heighten its estimated value, once it becomes generally known that physics is good for something. In meeting the demand for such evidence, the physics teacher will find the greatest opportunity for his own development and that of his beloved science.

E. H. JOHNSON

THE IRWIN EXPEDITION OF INDIANA UNIVERSITY TO PERU AND BOLIVIA

IN 1909 I summarized the knowledge of the distribution of South American fresh-water fishes in general. I dealt with the origin of the Pacific slope fish fauna in part in the following words:¹

There are four distinct faunas on the Pacific slope of America between Cape Horn and the Tropic of Cancer. One of these is of common origin with that on the Atlantic slope, one is autochthonous and the other two are derivative from the Atlantic slope faunas opposed to them.

1. The fauna of southern Chili is essentially like that of Patagonia, and inasmuch as it is largely made up of marine forms entering fresh water, and fresh-water forms entering the ocean, it seems very probable that the species migrated from river to river along the coast from Patagonia to Chili or from Chili to Patagonia.

2. At the other extreme in the Rio Mezquital of the Transition Region and the Yaqui just to the north of it there is a fauna essentially like that of the Rio Grande east of them. As Meek has pointed out, the Yaqui and Mezquital have captured tributaries of the Rio Grande together with the fishes in them, and the migration of Atlantic slope northern forms to the Pacific slope has been a passive one.

³⁴ *Scientific Monthly*, May, 1918, p. 406.

¹ Reports of the Princeton University Expeditions to Patagonia, III., 1909, p. 352.

Thus, types which in America north of Mexico have not succeeded in reaching the Pacific slope, have, within the Tropics, crossed the divide. . . .

3. The third fauna is the Mexican of the Rio de Santiago. This is undoubtedly the relict of an old fauna reenforced by a few immigrants from the north. It is here not a question of the origin of the fauna from an eastern one, but of an autochthonous development that has, on its part, contributed elements to the surrounding rivers. It passively contributed to the Atlantic slope fauna by having one of its small rivers captured by the Rio Panuco.

4. Of more particular interest is the origin of the fauna of western Peru and Ecuador and that of western Central America. Not enough is known of the fauna of the western part of Central America to attempt an explanation of its origin.

Concerning the Andean fauna I said in part, page 305:

The Andean region includes the high Andes on both slopes from Venezuela and Colombia to Chili.

It is poor in species at any given point, but some of the genera have a large number of local adaptations or species. This region is distinctly marked off into three provinces.

1. The Northern includes the highlands of northern Peru, Ecuador, Colombia and Venezuela. This is the richest in species and distinguished by the genera *Arges*, *Cyclopium*, *Prenadilla* and the high development of *Chaetostomus*. Its fauna is largely an ancient derivative from the lowland fresh-water fauna of Archiguiana.

2. The Titicacan, including the basin of Titicaca and neighboring streams, and possibly the land-locked basins of Bolivia, concerning which nothing is known, is distinguished by the genus *Orestias* and the absence of the genera distinguishing the northern province. Its fauna is largely an ancient derivative from the ocean.

3. The Southern is the poorest in species, characterized by the absence of everything but a few species of *Pygidium*, a genus which extends the entire length of the Andean region.

Further, p. 373, I said:

The points of strategic importance for ichthyic chorology in South America are, therefore, western Colombia and Panama, Guayaquil and Peru to the Amazon, across the Andes. . . .

Most of my time since the publication of the monograph quoted, in fact, since its preparation several years earlier, has been de-

voted to working out the details of a plan then made. I have had the cooperation of various institutions and individuals.

As part of this scheme I urged in *SCIENCE*, N. S., Vol. XXII, No. 549, pp. 553-556, the exploration of Panama before the canal should be completed. This work was well done by the late S. E. Meek and S. F. Hildebrand, under the auspices of the Field Museum and the Smithsonian Institution.

To examine conditions in Colombia I traveled in 1913 from Cartagena up the Magdalena to Girardot, thence to Bogotá in the eastern Cordilleras, thence across the Magdalena valley to Ibagué, across the central Andes to Cartago, up the Cauca valley to Cali, and across the western Andes to Buenaventura on the Pacific, thence up the Pacific slope stream San Juan, across the divide and down the Atlantic slope rivers, Quito and Atrato, to the starting point. My assistant during this trip, Mr. Manuel Gonzales, later visited the Atlantic slopes of the easternmost Andes between Bogotá and Barrigona, and Hermano Apolinar Maria, the efficient director of the Instituto de la Salle of Bogotá, had collections made for me in the Llanos east of Bogotá.

Mr. Hugh McK. Landon and Mr. Carl G. Fisher later enabled Mr. Arthur Henn, now in medical service with the American Expeditionary Forces, and Mr. Charles Wilson, also now in medical service, to explore the Patia and Atrato San Juan Basins of western Colombia, and still later Mr. Henn was enabled by Mr. Landon and Indiana University to explore the western slope of Ecuador, especially the Guayaquil basin.

Various attempts to secure the means to carry the work southward have failed until this spring, when the American Association for the Advancement of Science made me an appropriation of five hundred dollars, the Indiana University made a similar appropriation, and Mr. William G. Irwin, of Columbus, Indiana, sent the university a check to cover the larger part of the estimated expenses of the Peruvian part of the field work. The University of Illinois is providing the expenses of an assistant, Mr. William Ray Allen, who is to devote

his time largely to parasites, and Miss Adele Rosa Eigenmann, a medical student in Indiana University, is to go as a volunteer assistant. Submarines being willing, we are to sail June 21 and the expedition is to be known as the Irwin Expedition.

As far as field work may be planned in advance, it is the intention to cross from the Pacific to the Amazon basin in at least three points in Peru:

First, Pacasmayo over Cajamarca to Balzas on the Marañon. The fishes of Pacasmayo are known in part at least through collections made by Osgood, of the Field Museum. Nothing is known of the fauna of the Cajamarca valley and very little of that of the upper Marañon.

Second, Callao over Oroyo, Cerro de Pasco to Huanuco. An attempt will be made to secure the faunas of the Rimac, of the High Andean Lake Hunin, and of the head waters of the Huallaga.

Third, Mollendo, Arequipa, Puno, Cuzco and Rio Urubamba. Attempts will be made to get as complete a representation as possible of the fauna of the Andean Lakes Titicaca and Poopo, and of the Rio Urubamba of the Ucayale basin.

Fourth, etc., some work will be done in Bolivia and Chili, but this will depend largely upon whether additional sums become available.

The expedition as definitely planned ought to give us as fair a notion of the Pacific slope fauna from the desert of northern Chili to Ecuador as we have of the Pacific slope of Ecuador, Colombia and southern Panama, as well as of the fauna immediately east of the crest of the Andes in Peru.

I am indebted to the president and trustees of Indiana University, who have made it my duty to devote myself to the work as outlined for the time needed to complete it.

CARL H. EIGENMANN

SCIENTIFIC EVENTS

SCHOOL FOR OPTICAL MUNITION WORKERS

THE War Industries Board authorizes the announcement that some of the fundamental